

REVISION OF WORK PLAN
for the
Silver Lake - Locust Island Watershed
New Jersey

The section headed "PROVISIONS FOR OPERATION AND MAINTENANCE," on pages 14 and 15 of the work plan is revised to read as follows:

Land Treatment Measures

Land treatment measures will be operated and maintained by the landowners or operators under cooperative agreements with the Salem-Cumberland Soil Conservation District. The Soil Conservation District will encourage the farmers to maintain the measures and to keep them in good condition.

Structural Measures for Flood Prevention and Agricultural Water Management

The Silver Lake dike will be operated and maintained by the Thorofare Meadow Company.

That part of the Locust Island dike east of the highway bridge at Hancock's Bridge will be operated and maintained by the Township of Lower Alloways Creek. That part west of the bridge will be operated and maintained by the Locust Island Meadow Company. They will jointly take responsibility for the entire length of dike.

Inspections will be made during or immediately after each period of high water and, in the event of no high water, at frequent intervals. The entire dike and appurtenant sluices will be inspected.

The estimated annual operation and maintenance cost based on long term prices is \$2,247.

The operation and maintenance will be accomplished by equipment rental contracts and force account. This is the method that the Meadow Companies have followed in the past.

The Meadow Companies are set up under the laws of the State of New Jersey and their managers have legal authority to operate the dikes and sluices.

Funds for operation and maintenance will be obtained by the Meadow Companies through assessment of their members, and by the Township through taxation.

The Silver Lake dike will be jointly inspected, at least once a year, by representatives of the Soil Conservation Service and the Thorofare Meadow Company.

The Locust Island dike will be jointly inspected by representatives of the Soil Conservation Service, the Locust Island Meadow Company, and the Township of Lower Alloways Creek.

Inspection reports will be prepared by the local organisations for each inspection, and will be made available at any time to the Soil Conservation Service.

Specific maintenance agreements for structural measures will be executed between the SCS and the responsible local organizations prior to issuance of invitations to bid.

Attachment

TABLE 1 - ACTUAL PROJECT INSTALLATION COSTS

Silver Lake-Locust Island Watershed - New Jersey

January 31, 1963

| Item | Unit | Number Applied Total | Cost | | |
|--|-------|----------------------------|---------|-----------|-----------|
| | | | PL 566 | Other | Total |
| <u>LAND TREATMENT PRIMARILY FOR WATERSHED PROTECTION</u> | | | | | |
| Soil Conservation Service | | | | | |
| Contour Farming | acre | 6 | | 15.00 | 15.00 |
| Cover Cropping | acre | 372 | | 744.00 | 744.00 |
| Pasture Planting | acre | 170 | | 2,975.00 | 2,975.00 |
| Conservation Crop Rot. | acre | 702 | | 10,530.00 | 10,530.00 |
| Wildlife Borders | acre | 4 | | 168.00 | 168.00 |
| Crop Residue Mgt. | acre | 478 | | 2,390.00 | 2,390.00 |
| Wildlife Area Imp. | acre | 200 | | 18,720.00 | 18,720.00 |
| SCS Sub-total | | | | 35,542.00 | 35,542.00 |
| TOTAL LAND TREATMENT | | | | 35,542.00 | 35,542.00 |
| <u>STRUCTURAL MEASURES</u> | | | | | |
| Dikes | each | 2 | 194,539 | 51,963 | 246,502 |
| | miles | 3.3 | | | |
| TOTAL CONSTRUCTION COSTS | | | 194,539 | 51,963 | 246,502 |
| <u>INSTALLATION SERVICES</u> | | | | | |
| Engineering Services | | | 49,886 | - | 49,886 |
| Other | | | 28,690 | - | 28,690 |
| SCS Total | | | 78,576 | - | 78,576 |
| TOTAL INSTALLATION SERVICES | | | 78,576 | - | 78,576 |
| <u>OTHER COSTS</u> | | | | | |
| Land, Easements and R/W | | | - | 3,000 | 3,000 |
| Administration of Contracts | | | - | 1,900 | 1,900 |
| TOTAL OTHER COSTS | | | - | 4,900 | 4,900 |
| TOTAL INSTALLATION-STRUCTURES | | | 273,115 | 56,863 | 329,978 |
| GRAND TOTAL | | | 273,115 | 92,405 | 365,520 |

Final Table 1

W/S files

SECOND SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT

between the

Salem Soil Conservation District
Local Organization

Locust Island Meadow Company
Local Organization

Thorofare Meadow Company
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)
State of New Jersey

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, the Watershed Work Plan Agreement for the Silver Lake-Locust Island Watershed, State of New Jersey, executed by the sponsoring local organization named therein and the Service, became effective on the 22nd day of May, 1957; and

Whereas, in order to carry out the watershed work plan for said Watershed, it has become necessary to modify said Watershed Work Plan Agreement;

Now, therefore the Sponsoring Local Organization and the Service hereby agree upon the following modifications of the terms, conditions, and stipulations of said Watershed Work Plan Agreement;

The Salem Soil Conservation District, having been organized to replace the now defunct Salem-Cumberland Soil Conservation District in Salem County, hereby assumes all obligations once vested in the Salem-Cumberland Soil Conservation District in carrying out the provisions of the Silver Lake-Locust Island Watershed Work Plan.

The Sponsoring Local Organization and the Service further agree to all other terms, conditions and stipulations of said Watershed Work Plan Agreement not modified herein.

Salem Soil Conservation District
Local Organization

By Newton S. Layton
Title Chairman
Date 6/13/67

The signing of this agreement was authorized by a resolution of the governing body of the Salem Soil Conservation District

adopted at a meeting held on 6/13/67
Local Organization

Richard de Wilde
(Secretary, Local Organization)

Date 6/13/67

Locust Island Meadow Company
Local Organization

By Gerald W. Pentecost
Title Manager
Date 6/10/67

The signing of this agreement was authorized by a resolution of the governing body of the Locust Island Meadow Company

adopted at a meeting held on 6/10/67
Local Organization

Richard W. P. Hem
(Secretary, Local Organization)

Date 6/10/67

- 3 -

Thorofare Meadow Company

Local Organization

By

Title

Date

John P. Pincus Jr.
Manager
6/3/67

The signing of this agreement was authorized by a resolution of the governing body of the Thorofare Meadow Company

Local Organization

adopted at a meeting held on

6/7/67
Frank A. Shimp
(Secretary, Local Organization)

Date

6/28/67

Soil Conservation Service
United States Dept. of Agriculture

By

Richard W. Abeley
(Administrator or
State Conservationist)

Date

6/30/67

SUPPLEMENTAL TABLE 1 - ESTIMATED INSTALLATION COSTS

Silver Lake-Locust Island Watershed - New Jersey

(Price Base - 1955)

For 1957 fiscal year

| Items | Unit | Estimated Cost | | | |
|-----------------------------------|------|----------------|-----------|---------|-------|
| | | No. to be: | applied : | Non : | : |
| | | Total | Federal | Federal | Total |
| LAND TREATMENT PRIMARILY FOR | | | | | |
| 1. Watershed Protection | | | | | |
| Soil Conservation Service | | | | | |
| Contour Farming | acre | 00 | 00 | 00 | 00 |
| Cover Cropping | acre | 00 | 00 | 00 | 00 |
| Field Diversion | mile | 00 | 00 | 00 | 00 |
| Pasture Planting | acre | 00 | 00 | 00 | 00 |
| Conservation Crop Rotation | acre | 00 | 00 | 00 | 00 |
| Waterway Development | acre | 00 | 00 | 00 | 00 |
| Wildlife Borders | acre | 00 | 00 | 00 | 00 |
| Crop Residue Management | acre | 00 | 00 | 00 | 00 |
| Wildlife Area Improvement | acre | 00 | 00 | 00 | 00 |
| SCS Subtotal | | 0 | 0 | 0 | 0 |
| TOTAL LAND TREATMENT | | 0 | 0 | 0 | 0 |
| STRUCTURAL MEASURES | | | | | |
| Soil Conservation Service | | | | | |
| Dikes | each | 00 | 00 | 00 | 00 |
| TOTAL CONSTRUCTION COSTS | | 0 | 0 | 0 | 0 |
| INSTALLATION SERVICES | | | | | |
| Soil Conservation Service | | | | | |
| Engineering Services | | | 296 | 0 | 296 |
| Other | | | 0 | 0 | 0 |
| SCS Total | | | 296 | 0 | 296 |
| TOTAL INSTALLATION SERVICES | | | 296 | 0 | 296 |
| OTHER COSTS | | | | | |
| Land, Easements and Rights-of-way | | | | | |
| Administration of Contracts | | | | | |
| TOTAL OTHER COSTS | | 0 | 0 | 0 | 0 |
| TOTAL INSTALLATION - STRUCTURES | | | 296 | 0 | 296 |
| GRAND TOTAL | | | 296 | 0 | 296 |
| SUMMARY | | | | | |
| Total SCS | | | 296 | 0 | 296 |
| TOTAL | | | 296 | 0 | 296 |

June 1957

SUPPLEMENTAL TABLE 1 - ESTIMATED INSTALLATION COSTS

Silver Lake-Locust Island Watershed - New Jersey

(Price Base - 1955)

For 1958 fiscal year

| Items | No. to be: | | Estimated Cost | | |
|-------------------------------------|------------|-----------|----------------|-----------|--------|
| | Unit: | applied : | Non- | : | : |
| | | Total : | Federal : | Federal : | Total |
| | | : | : | : | : |
| <u>LAND TREATMENT PRIMARILY FOR</u> | | | | | |
| 1. Watershed Protection | | | | | |
| Soil Conservation Service | | | | | |
| Contour Farming | acre | 10 | - | 25 | 25 |
| Cover Cropping | acre | 40 | - | 80 | 80 |
| Field Diversion | mile | 0.2 | - | 40 | 40 |
| Pasture Planting | acre | 20 | - | 350 | 350 |
| Conservation Crop Rotation | acre | 40 | - | 600 | 600 |
| Waterway Development | acre | 1 | - | 100 | 100 |
| Wildlife Borders | acre | 1 | - | 42 | 42 |
| Crop Residue Management | acre | 80 | - | 400 | 400 |
| Wildlife Area Improvement | acre | 80 | - | 1600 | 1600 |
| SCS Subtotal | | - | - | 3237 | 3237 |
| TOTAL LAND TREATMENT | | | | 3237 | 3237 |
| <u>STRUCTURAL MEASURES</u> | | | | | |
| Soil Conservation Service | | | | | |
| Dikes | each | 2 | 107705 | 28775 | 136480 |
| TOTAL CONSTRUCTION COSTS | | | 107705 | 28775 | 136480 |
| <u>INSTALLATION SERVICES</u> | | | | | |
| Soil Conservation Service | | | | | |
| Engineering Services | | | 27000 | 0 | 27000 |
| Other | | | 13916 | 0 | 13916 |
| SCS Total | | | 40916 | 0 | 40916 |
| TOTAL INSTALLATION SERVICES | | | 40916 | 0 | 40916 |
| <u>OTHER COSTS</u> | | | | | |
| Land, Easements and Rights-of-way | | | 0 | 2000 | 2000 |
| Administration of Contracts | | | 0 | 2000 | 2000 |
| TOTAL OTHER COSTS | | | 0 | 4000 | 4000 |
| TOTAL INSTALLATION - STRUCTURES | | | 148621 | 32775 | 181396 |
| GRAND TOTAL | | | 148621 | 36012 | 184633 |
| <u>SUMMARY</u> | | | | | |
| Total SCS | | | 148621 | 36012 | 184633 |
| TOTAL | | | 148621 | 36012 | 184633 |

June 1957

SUPPLEMENTAL TABLE 1 - ESTIMATED INSTALLATION COSTS
Silver Lake-Locust Island Watershed - New Jersey
(Price Base - 1955)

For 1959 fiscal year

| Items | Unit | No. to be: | | Estimated Cost | |
|-----------------------------------|------|------------|---------|----------------|-------|
| | | applied : | Non- | | |
| | | Total | Federal | Federal | Total |
| LAND TREATMENT PRIMARILY FOR | | | | | |
| 1. Watershed Protection | | | | | |
| Soil Conservation Service | | | | | |
| Contour Farming | acre | 10 | 0 | 25 | 25 |
| Cover Cropping | acre | 40 | 0 | 80 | 80 |
| Field Diversion | mile | 0.2 | 0 | 40 | 40 |
| Pasture Planting | acre | 20 | 0 | 350 | 350 |
| Conservation Crop Rotation | acre | 40 | 0 | 600 | 600 |
| Waterway Development | acre | 1 | 0 | 100 | 100 |
| Wildlife Borders | acre | 1 | 0 | 42 | 42 |
| Crop Residue Management | acre | 80 | 0 | 400 | 400 |
| Wildlife Area Improvement | acre | 80 | 0 | 1600 | 1600 |
| SCS Subtotal | | | | 3237 | 3237 |
| TOTAL LAND TREATMENT | | | | 0 | 3237 |
| STRUCTURAL MEASURES | | | | | |
| Soil Conservation Service | | | | | |
| Dikes | each | | | | |
| TOTAL CONSTRUCTION COSTS | | | | 0 | 0 |
| INSTALLATION SERVICES | | | | | |
| Soil Conservation Service | | | | | |
| Engineering Services | | | | | |
| Other | | | | | |
| SCS Total | | | | | |
| TOTAL INSTALLATION SERVICES | | | | | |
| OTHER COSTS | | | | | |
| Land, Easements and Rights-of-way | | | | | |
| Administration of Contracts | | | | | |
| TOTAL OTHER COSTS | | | | 0 | 0 |
| TOTAL INSTALLATION - STRUCTURES | | | | 0 | 0 |
| GRAND TOTAL | | | | 0 | 3237 |
| SUMMARY | | | | | |
| Total SCS | | | | 0 | 3237 |
| TOTAL | | | | 0 | 3237 |

June 1957

SUPPLEMENTAL TABLE 1 - ESTIMATED INSTALLATION COSTS

Silver Lake-Locust Island Watershed - New Jersey

(Price Base - 1955)

For Remaining Years

| Items | Unit | No. to be: | | Estimated Cost | |
|-----------------------------------|------|------------|---------|----------------|-------|
| | | applied : | Non- | : | : |
| | | Total | Federal | Federal | Total |
| LAND TREATMENT PRIMARILY FOR | | | | | |
| 1. Watershed Protection | | | | | |
| Soil Conservation Service | | | | | |
| Contour Farming | acre | 30 | " | 75 | 75 |
| Cover Cropping | acre | 120 | " | 240 | 240 |
| Field Diversion | mile | 0.6 | " | 120 | 120 |
| Pasture Planting | acre | 60 | " | 1050 | 1050 |
| Conservation Crop Rotation | acre | 120 | " | 1800 | 1800 |
| Waterway Development | acre | 3 | " | 300 | 300 |
| Wildlife Borders | acre | 3 | " | 126 | 126 |
| Crop Residue Management | acre | 240 | " | 1200 | 1200 |
| Wildlife Area Improvement | acre | 240 | " | 4800 | 4800 |
| SCS Subtotal | | | " | 9711 | 9711 |
| TOTAL LAND TREATMENT | | | " | 9711 | 9711 |
| STRUCTURAL MEASURES | | | | | |
| Soil Conservation Service | | | | | |
| Dikes | each | | | | |
| TOTAL CONSTRUCTION COSTS | | | 0 | 0 | 0 |
| INSTALLATION SERVICES | | | | | |
| Soil Conservation Service | | | " | " | " |
| Engineering Services | | | " | " | " |
| Other | | | " | " | " |
| SCS Total | | | " | " | " |
| TOTAL INSTALLATION SERVICES | | | 0 | 0 | 0 |
| OTHER COSTS | | | | | |
| Land, Easements and Rights-of-way | | | 0 | 0 | 0 |
| Administration of Contracts | | | 0 | 0 | 0 |
| TOTAL OTHER COSTS | | | 0 | 0 | 0 |
| TOTAL INSTALLATION - STRUCTURES | | | 0 | 0 | 0 |
| GRAND TOTAL | | | 0 | 9711 | 9711 |
| SUMMARY | | | | | |
| Total SCS | | | 0 | 9711 | 9711 |
| TOTAL | | | 0 | 9711 | 9711 |

June 1957

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOMERSET, NEW JERSEY 08873
October 17, 1972

REPORT OF INVESTIGATIONS OF STRUCTURAL DEFICIENCY

Silver Lake - Locust Island
Tributaries of Maurice River Cove Watersheds
Corrosion and Failure of Tidegate Structures

AUTHORITY

Letter dated 7/14/72 from W. J. Parker
State Conservationist to Carmelo J. Montana
Design Engineer

INVESTIGATING COMMITTEE

Carmelo J. Montana, Design Engineer
Roy E. Bright, Construction Engineer
Richard T. Barlow, Hydraulic Engineer

LIST OF ATTACHMENTS

- | | |
|-----------|---------------------------|
| EXHIBIT 1 | TABLE OF PERTINENT DATA |
| EXHIBIT 2 | PHOTOGRAPHS OF GATE STUBS |
| EXHIBIT 3 | WATER ANALYSIS |
| EXHIBIT 4 | CORRESPONDENCE |

DESCRIPTION OF THE PROJECTS

Silver Lake - Locust Island Watershed

The Silver Lake - Locust Island Watershed lies in the southern tip of Salem County. It surrounds the village of Hancock's Bridge. Its 5,590 acres comprises approximately one-fifth of the Township of Lower Alloways Creek.

The Silver Lake dike protects Silver Lake meadow against tidal inundation from the Delaware Bay. A battery of three (3) corrugated metal pipes, 36 inches in diameter, with drainage gates, were installed. The gates were installed to allow for removal of interior runoff while protecting against tides.

The Locust Island dike protects the Town of Hancock's Bridge and surrounding cropland against inundation from tidal waters in Alloways Creek. There are two tidegate installations through the Locust Island dike. One installation consists of a single 36 inch diameter corrugated metal pipe and drainage gate. The other consists of a battery of four (4) 36 inch diameter corrugated metal pipes with drainage gates.

Tributaries of Maurice River Cove Watershed

This watershed project is located in Cumberland County, New Jersey. It has a drainage area of approximately 6,900 acres.

The project consists of stream channel improvement for both drainage and flood prevention on Dickey's Ditch and New England Creek. Wildlife improvement measures were installed in the area surrounding Matts Landing. They consisted of about 2.4 miles of dike, two tidegate structures and one water control structure. In addition, one tidegate structure was installed on Dickey's Ditch.

At Matts Landing one structure consisted of a 36 inch diameter corrugated metal pipe through the dike with combination slide and flap gates on each end. The water control structure consisted of a 24 inch diameter corrugated metal pipe through the dike with a flashboarded concrete riser on the inland side. The second tidegate structure consisted of a 36 inch diameter corrugated metal pipe with combination slide and flap gates on each end.

The structure at Dickey's Ditch consisted of two 36 inch diameter corrugated metal pipes with flap gates on one end.

DESCRIPTION OF AFFECTED AREA

The nature of the deficiency is a loss of effectiveness of the tidegate structures due to corrosion of the corrugated metal pipe stubs. The corrosion created holes allowing water to bypass the gates and, in some instances, caused the gate to completely fall off the stub.

Silver Lake - Locust Island Watershed

The single 36 inch diameter corrugated metal pipe through the Locust Island dike was replaced in its entirety in 1969. The replacement pipe was identical to that called for in the original design. At the time of repair, the original gate was attached directly to the corrugated metal pipe; no stub was utilized. This structure is presently in good condition.

One of the structures in the battery of four through the Locust Island Dike has been repaired. The other three are in need of repair.

All structures in the battery of three through the Silver Lake dike have been repaired. The repairs consisted of replacing the three badly corroded asbestos bonded, asphalt coated corrugated metal pipe stubs with aluminum stubs. The original cast iron gates were then attached to the aluminum stubs.

Tributaries of Maurice River Cove Watershed

The 36 inch diameter corrugated metal pipe, gate, and timber structure at Matts Landing (Station 39+35) have been completely buried and rendered ineffective. They have been replaced by a 48 inch diameter corrugated aluminum pipe having a flashboard structure on the inland side of the dike.

The 24 inch diameter corrugated metal pipe and riser have been removed. No replacement was made.

The 36 inch diameter pipes in the wildlife area (Sta. 99+00) with combination slide and flap gates are in good condition. The original 36 inch diameter corrugated metal pipes and gates installed at Dickey's Ditch are in good condition at this time.

FINDINGS

Design

Silver Lake - Locust Island Structural Measures:

The design was prepared by Richard H. Marston, Engineering Specialist, Soil Conservation Service, New Jersey. It was completed in early 1958. The design was approved by Kenneth S. Werkman, State Conservation Engineer, New Jersey, and reviewed and approved by the Engineering and Watershed Planning Unit, Upper Darby, Pennsylvania, Fred H. Larson, Head.

A total of eight pipes and gates were called for. One structure was placed singularly, the others were placed in batteries of three and four.

The plans and specifications called for all eight pipes to be 36 inch diameter, asbestos-bonded, bituminous coated. The specifications called for the gates to be factory mounted on pipe stubs. The method of mounting, including type of bolts if any to be used, as well as the coating or treatment to be applied to that area was not stipulated.

There is no correspondence in the design file between pipe suppliers and the Soil Conservation Service pertaining to the use of asbestos-bonded, bituminous coated pipe in this chemical environment. Nor is there any mention of its life expectancy.

There is no record of pH or resistivity test having been run on the soil nor is there any record of tests being made for sulfate content or pH of the water. No cathodic protection was called for.

Tributaries of Maurice River Cove, Structures at Matts Landing, Sta. 39+35:

The design was prepared by Robert H. Fox, Civil Engineer, SCS, New Jersey. It was approved by Kenneth S. Werkman, State Conservation Engineer, SCS, New Jersey and reviewed and approved by the Engineering and Watershed Planning Unit, Upper Darby, Pennsylvania, Harold M. Kautz, Head.

The design was completed in 1962. The plans called for the 36 inch diameter corrugated metal pipe, coupling bands, and anti-seep collars to be bituminous coated and asbestos bonded. The pipe was to be 12 gage.

Pipe joints were to be wrapped with asphalt impregnated paper under the pipe couplings. All damaged area in the pipe coating were to be repaired with an asphaltic compound approved by the engineer.

The plans called for the 36 inch diameter combination slide and flap gates to be supplied with a two foot length of 36 inch diameter corrugated metal pipe attached.

There is no record of any consideration being given to the possibility of corrosive action on the pipes during the design phase of this project. No resistivity of pH tests were run on the soil. No water analysis were made.

Tributaries of Maurice River Cove, Structure on Dickey's Ditch:

The design was prepared by Robert H. Fox, Design Engineer, SCS, New Jersey. It was approved by Kenneth S. Werkman, State Conservation Engineer, SCS, New Jersey and reviewed and approved by the Engineering and Watershed Planning Unit, Upper Darby, Pennsylvania, Harold M. Kautz, Head.

The design was completed in 1963. The plans called for two 36 inch diameter corrugated metal pipes, 12 gage, with flap gates on each one. All corrugated metal pipes, coupling bands, and anti-seep collars were to be asbestos bonded and bituminous coated. The flap gates were to be supplied mounted to a two foot length of bituminous coated, asbestos-bonded, 12 gage corrugated metal pipe.

There is no record of any tests having been made on the soil or water to evaluate the possibility of corrosion. There is also no record of any correspondence with the pipe supplier regarding either the use of bituminous coated, asbestos-bonded pipe in the salt water environment or the method of mounting the gate to the pipe stub.

Tributaries of Maurice River Cove, Wildlife Structure, Sta. 99+00:

The design was prepared by Robert H. Fox, Design Engineer, SCS, New Jersey. It was approved by Kenneth S. Werkman, State Conservation Engineer, SCS, New Jersey.

The design was complete in 1965. The note on the plans called for a 36 inch diameter, 10 gage, bituminous coated and asbestos-bonded corrugated metal pipe. The specifications called for a Type D coating which is "paved invert only".

The gates were to be supplied attached to the pipe in such a way as to be fully supported by the pipe.

There is no record of any tests having been made on the soil or water to evaluate the possibility of corrosion. There is also no record of any correspondence with pipe suppliers pertaining to their recommendations.

Construction

All documentation pertaining to the installation of the corrugated metal pipes and flap gates were reviewed for each watershed. In addition, discussions were held with John Haldeman, the construction inspector on Silver Lake - Locust Island Watershed

The contract for construction of the dike and tidegates on Silver Lake - Locust Island was modified to delete specification requirements for welded seams.

There was no indication found in the records of any damage to the pipe coatings during construction.

Pertinent data relating to the pipes is, summarized in the attached table (Exhibit 1).

CONCLUSIONS

The committee concluded that all pipes and stubs were asbestos bonded and bituminous coated.

Erosion of the coating by moving soil particles does not appear to be a cause of the failures. The bituminous coating along the invert of the pipes and stubs had been eroded away to some extent; however, only slight corrosion had occurred in that area. The lower portions of the pipe, and

the invert especially, where particles would be expected to have the most erosive effect, showed the least corrosion. On one stub in particular the major portion of the corrosion occurred in an area approximately 60 degrees on either side of the crown. This is the area most subject to wetting and drying. (See the attached pictures - Exhibit 2). In all cases, the majority of the corrosion occurred within the 8 to 12 inches of the stub closest to the gate.

The committee believes the failures are due to a combination of causes. A galvanic cell was created when the cast iron gate was attached to the zinc coated corrugated pipe. The zinc, being anodic to the iron, dissolved. The mechanical protection the zinc provided to the pipe was, therefore, lost exposing the base metal to the salt water.

Another galvanic cell was created when the holes were drilled through the stubs to mount the gates. Prior to drilling the holes, the zinc provided mechanical protection to the pipe and prevented the salt water, an excellent electrolyte, from reaching the base metal. When the holes were drilled, the bare metal became exposed directly to the sea water and a galvanic cell was created between the zinc coating and the base metal. The zinc again became the anode and dissolved.

In this installation, the protective coating appeared to have little effect on stopping the corrosion. In examining the most severely corroded stub, it appeared as though there were areas that were not asbestos bonded. In addition, the coating may have been damaged around the pipe circumference in the process of mounting the gates. Areas exposed in this way would provide for concentrated galvanic action.

It appeared in all cases that once corrosion started, the protective coatings were undercut and had little effect on stopping further corrosive action.

RECOMMENDATIONS

1. The committee believes that to avoid possible electrolytic action, cast iron water control gates should not be attached directly to metal pipes. The pipe should be brought through a headwall and the gate attached to the headwall. The headwall should be constructed of timber or salt and sulfate resistant concrete and will probably require pile support.

2. Consideration should be given to the use of timber sluices, and concrete, plastic or fiberglass pipe. Fiberglass pipe is being used to some extent on tidal structures in New Jersey but in no case has it been installed long enough to be evaluated. More observation and investigation needs to be done pertaining to the use of fiberglass pipe.

Concrete pipe through a concrete headwall with the water control gate attached to the headwall would be an excellent arrangement for resisting erosion. A detailed foundation investigation would be required in the area of the structure and a settlement analysis would be mandatory. Pre-loading the area in which the pipe is to be placed should be considered. In the case of the existing dikes on which the failures have occurred, consideration should be given to using concrete pipe inasmuch as these foundations have now been loaded for 10 to 15 years. The proper foundation investigation would be required. The salt and sulfate condition should be considered in the design of the concrete pipe and headwall.

Timber "pipes" have been used with great success by the local people. Timber gates are generally attached to the timber sluice.

When timber or metal pipe is used, it is important that the pipe be placed low enough to avoid its being subjected to wetting and drying action. The Maurice River Cove structure at Station 39+35 was placed low to avoid the problem of wetting and drying, however, complaints were received from the sponsors that the gates become jammed with debris as the area around the gate silted in. When placed too deep, jamming and maintenance become a problem.

3. Consideration should be given to the use of timber or concrete tidegate structures that do not utilize pipe. These generally provide a good alternative to pipe structures when it is not necessary to carry a road over the structure. Placing a road over these pipeless structures is usually expensive.

4. In the future, consideration should be given to the use of cathodic protection when metal pipe is used. The cathodic protection should be used in conjunction with protective coatings. When cathodic protection is utilized, the maintenance aspect should be stressed to the responsible parties.

Respectfully submitted:



Carl Montana, Chairman Investigating Committee



Donald W. Haslem, State Conservation Engineer

EXHIBIT 1

| Project | Location | No. & Diameter | Gage | Treatment | Dates | | Remarks |
|---------------|-------------------|----------------|------|-----------|------------|-----------|--|
| | | | | | Installed | Failed | |
| Silver Lake | Q Dike Sta 37+72 | 3 - 36 inch | 12 | GALV-BCAB | May 1960 | May 1972 | One gate fell off; others - poor condition |
| Locust Island | E Dike Sta. 11+80 | 1 - 36 inch | 12 | GALV-BCAB | Oct. 1959 | Aug. 1969 | Failure blamed on slamming; severe corrosion evident |
| Locust Island | Q Dike Sta. 24+30 | 4 - 36 inch | 12 | GALV-BCAB | Sept. 1959 | Dec. 1970 | One gate fell off; repaired; condition of remaining three leaking then. Checked Sept. 1972 and all three leaking badly |
| Maurice River | | | | | | | |
| Dickeys Ditch | Q Dike Sta. 4+93 | 2 - 36 inch | 12 | GALV-BCAB | Nov. 1964 | - | |
| Wildlife Area | Q Dike Sta. 39+35 | 1 - 36 inch | 12 | GALV-BCAB | Jan. 1963 | Aug. 1971 | O&M Report noted gate assembly missing |
| Wildlife Area | Q Dike Sta. 99+00 | 1 - 36 inch | 10 | GALV-BCAB | June 1966 | - | |

February 4, 1975

Supplemental Report
to
Report of Investigation of Structural Deficiency
October 17, 1972

INTRODUCTION

Repairs are currently underway on the tidegate structures of the Silver-Lake-Locust Island Watershed Project. In undertaking these repairs certain other necessary repairs have come to light. This report is intended to supplement the "Report of Investigations of Structural Deficiency" dated October 17, 1972 to include structural conditions that have been revealed at the inlet of the Silver Lake structure. Kenneth E. Grant's letter of November 12, 1973 approved expenditure of funds to undertake the repairs as outlined in the deficiency report.

The Silver Lake dike protects Silver Lake meadow, considered as the best fresh water muskrat marsh in the State, from tidal inundation from Delaware Bay. A battery of three corrugated metal pipes, 36 inches in diameter, with drainage gates, were installed. The gates were installed to allow for removal of interior runoff while protecting against tides.

FINDINGS

In conjunction with the approved repairs to the water control gates and outlet facilities of the Silver Lake-Locust Island Watershed Project, dewatering of the Silver Lake tidegate structure has revealed that the inlet facilities are also in need of repair. As a background to this problem the sponsors brought to our attention at the time final plans for approved repairs were being made that they had lost the ability to control water levels on the land side of the dike.

Their general belief at that time was that the pipes had developed holes and that the flash boarded timber water control structure was still in good condition. Investigations were made but without dewatering it was impossible to tell exactly

what the problem was at that time. It was, therefore, decided that a modification would have to be made in the contract if the pipes were in fact found to be in poor condition when the repairs were being made.

During the performance of the repair to the gates under the present contract the sponsors borrowed steel sheeting from the county and agreed to pay the contractor to drive them and dewater the land side of the dike to determine the condition of the pipes. Upon completion of dewatering it was discovered that the pipes were in good condition and that the major problem is actually with the timber inlet structure.

The timber inlet structure, which was installed as a change during the original construction, has apparently been displaced due to uplift. The timbers which make up the structure are out of place to the extent that considerable flow has entered through holes in the back or fill side of the structure. An extensive amount of erosion has damaged the dike. This erosion has progressed to a point that the entire inland portion of the dike at the structure location is endangered and is beginning to slide at this point.

Repair of the existing wooden inlet structure was considered at first but further investigation has indicated that its' condition has deteriorated to an extent that would exclude this as a viable alternative. These investigations also revealed that the interior portions of the 36" CM pipes are still in good condition. The protective coatings have eroded away at the inlet end for a distance of from 18" to 24" and severe corrosion has occurred in this area.

CONCLUSIONS

The inlet conditions revealed by dewatering at the Silver Lake structure are such that extensive and immediate repairs are necessary. Unless these repairs are made expeditiously the entire structure including the approved repair to the water control gates and outlet facilities will be endangered and subject to failure.

The present inlet structure has established the conditions by which this tidegate structure will function and proposed repairs should take this into consideration. Repairs should include replacement of the damaged ends of the pipes, necessary extensions of the pipes to provide proper length, replacement of eroded fill material, protection of the bank against future erosion, a riser with equivalent weir length to the existing inlet structure and protection against uplift conditions.

All portions of this structure, including the inlet, outlet, dike and pipes need to function as one unit. It is, therefore, important that all defective areas be repaired to provide a viable installation.

RECOMMENDATIONS

It is recommended that the Silver Lake structure be repaired to operate as originally installed. These repairs should include removal of 2 feet of the damaged end of each of three 36" diameter pipes and extension of these pipes to a properly located riser. The risers should be 48 inch half-round pipes with flash boards or a similar installation and anchored against uplift with driven piles and walers. The embankment should be replaced and protected with rock riprap to the same specifications as provided for the outward side of the dike.

The protection for the pipe structures should be the same as required for the original installation and all field joints should be adequately treated.

It is further recommended that these repairs be carried out with the existing contract for repair of this structure and the necessary approvals be obtained so that the contract can be modified to include these additions.

Respectfully submitted:

DONALD W. HASLEM
State Conservation Engineer

Supplemental Report Number 2
to
Report of Investigation of Structural Deficiency
October 17, 1972

ADDITIONAL FINDINGS

The Silver Lake intake structure was inspected on January 16, 1975 by R. Marston, Assistant State Conservationist; D. Haslem, State Conservation Engineer; C. Montana, Assistant State Conservation Engineer; E. Helmey, Construction Engineer, Upper Darby and J. Haldeman, SCS inspector. It was the combined opinion of this group that the structure has moved and been displaced from its original position. The attached photographs show the condition of the inlet facility at Silver Lake on January 16, 1974 after being dewatered by the contractor.

The "As-Built" drawings indicate that the invert of the inlet structure was installed to an elevation of -5.0 ft. M.S.L. A survey of the inlet made in February, 1975 shows, that the front of the box is an average of 0.75 feet higher than when installed. This displacement has caused the boards which make up the structure to move from their original position to the extent that a considerable amount of leakage has occurred at all joints. This not only keeps the Meadow Company from maintaining the desired water level in the marsh but also has resulted erosion of the fill on the dike slope at the rear of the intake structure. (See photo. #2, Attachment #1).

Frequent maintenance has been carried out on this structure over the past 14 years for the purpose of sustaining the water-tightness of the inlet box. During this period the sponsors installed a concrete collar around the pipe inlets as can be seen in Photograph #1 of Attachment #1. This may have contributed to the deterioration of the 18" to 24" of the pipe inlet as reported in the February 4, 1975 supplemental report.

The construction records, which have now been retrieved from the archives, reveal that a contract modification was made on November 2, 1959 to promulgate the substitution of the

Silver Lake inlet structure inplace of the full length of 36" C.M.P. which could not be obtained at that time. A copy of this modification along with exerpts from the construction diary and cost estimates are attached to provide historical background documentation to the reasons why this change was made during construction. (Attachments 2, 3 and 4).

The change was made without an increase or decrease in contract cost or revision in cost sharing arrangements. The design of the inlet structure was a simple modification of the timber outlet facility with the addition of rectangular sides to allow water control in the marsh by inclusion of boards in the front of the structure. A side elevation of this outlet structure from the construction plans is attached for illustrative purposes. (Attachment #5).

There is no indication that the inlet structure was designed for the additional uplift forces due to buoyancy of inlet box created by the modification. However, the structure has, with frequent maintenance, functioned adequately until only recently. Computations made for the purpose of this supplement show that the resistance provided by the eight 12 foot posts as installed are far exceeded by the possible maximum uplift forces that can occur.

A handwritten signature in cursive script, reading "Donald W. Haslem".

DONALD W. HASLEM, P.E.
State Conservation Engineer

NEW JERSEY DAIRY LABORATORIES

222-226 EASTON AVENUE

201: 249-0148

P. O. BOX 748

NEW BRUNSWICK, N. J. 08903

EXHIBIT 3

Water Sample Taken
8/22/72 By Bright
Silver Lake
Sta. 37+72

REPORT ON WATER SAMPLES

Soil Conservation Service
1370 Hamilton St
Somerset, N. J.
Att: Mr. Carl Montana

DATE Aug. 25, 1972 NO. 8585

COPY

IDENTIFICATIONS:

Water Sample #1

SAMPLES:

| | | | | | |
|---------------------|----------------|--------------------|-----------------------|---------------------|----------------------|
| Received on: | Delivered by: | Refrigerated: | Taken by: | On: | Refrigerated: |
| 8/23 | | | | | |
| In Glass Container: | Sterilized by: | Thiosulfate Added: | At Site: ppm Chlorine | At Site: pH reading | At Site: Water Temp. |

BACTERIAL DATA:

| TOTAL AGAR PLATE COUNTS | | COLIFORMS in Five 10, 1 and 0.1 ml. Tubes | | | Pertinent Bacterial Standards |
|-------------------------|-----------------------------------|---|-------------------------------------|--------------------------------------|----------------------------------|
| 35°C. Incub. | Colonies per ml.: 20°C. Incub. | Presumptive Test: Tubes "POSITIVE" | Confirmed Test: Tubes "POSITIVE" | Equivalency, or "MPN per 100 ml." | |
| | | | | | SATISFIED |

CHEMICAL DATA

| | |
|------------------------------|-------|
| pH | 7.1 |
| Chlorides as Cl | 0.53% |
| Sulphates as SO ₄ | 0.10% |

Maurice Weber
Maurice Weber, Director

BACTERIAL STANDARDS:

To be "satisfactory", five 10 ml. (thus 50 ml.) portions of properly representative samples of drinking waters and swimming pool waters must show the complete absence of coliforms, by the codes of both the U. S. Public Health Service and the N. J. State Department of Health. Total bacterial counts of swimming pool waters must not exceed 250 colonies per ml.

NOTES:

1. We certify that our analyses of water samples are made in full conformance with the appropriate procedures specified in "Standard Methods for the Examination of Water", and are accurate to within the experimental errors of these techniques.
2. We certify that samples of water, taken by our representatives, have been prepared and transported to the laboratory in full con-

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SUBJECT: WS-PL-566 - Structure Deficiency, Tidegate
Structures, Silver Lake-Locust Island and Tributaries
of Maurice River Cove Watersheds

TO: Carmelo J. Montana
Design Engineer
SCS, Somerset, New Jersey

DATE: July 14, 1972

It has been brought to my attention that structure deficiencies exist at the subject watersheds. The nature of the deficiency is corrosion of the outlet end of the corrugated metal pipe in the tidegate structures.

I would like for you to chair the investigating committee. The other members will be: Roy E. Bright, Construction Engineer and Richard T. Barlow, Hydraulic Engineer.

You should refer to Engineering Memorandum-53 for guidelines and procedures for preparing the report.

Please submit the report to me by September 15, 1972.



W. J. PARKER
State Conservationist

cc: Roy E. Bright
Ronald C. Page



P. O. Box 219, 1370 Hamilton Street, Somerset, New Jersey 08873

July 21, 1972

Mr. Dale K. Smith
Armco Steel Corporation
Metal Products Division
1020 Barclay Building
Bala Cynwyd, Pa. 19004

Dear Mr. Smith:

I have included a picture of one of the tide gates that has fallen off in South Jersey. As you may be able to see, the failure did not seem to occur at the bolts.

As soon as you have any information pertaining to the Silver Lake - Locust Island structure, please let me know.

Sincerely,

CARL MONTANA, P.E.
Design Engineer

Enclosure

CM/jb

ARMCO STEEL CORPORATION

METAL PRODUCTS DIVISION

ADDRESS REPLY TO
P. O. BOX 6793
BALTIMORE, MD. 21204

August 2, 1972

U. S. Department of Agriculture
Soil Conservation Service
P. O. Box 219
1370 Hamilton Street
Somerset, New Jersey 08873

Attention Mr. Carl Montana, P.E.
Design Engineer

Reference Tide Gates

Gentlemen:

Your letter of July 21 with drawing and photograph attached has been referred to this office for comment. We certainly understand your concern for failure of this type and would like to pursue the facts behind the failure to assist our people in making a proper recommendation for future installations.

I would appreciate it if you could tell us whether the material was coated galvanized, or coated ASBESTOS BONDED corrugated pipe. Also, the gage of the material, if known. It would be most helpful and necessary to have an analysis of the water or a description of the effluent and what pH ranges can be expected. Any unusual acids or other contents of the water would help in an overall analysis.

As you know, our company makes a wide variety of corrosion resisting steels for both corrugated pipe and water control gates. Also, there are any number of epoxies or other type exotic coatings which can be used for additional life design. However, it is necessary to weigh the life expectancy against the cost of such structures for a reasonable and economical life design.

August 2, 1972
U. S. Department of Agriculture

page 2

After receiving the information I have requested, we will analyze the situation and make recommendations on material to use in attaching to the gate and also our comments on the proposed remedial measures which you have shown on the drawing.

Very truly yours,

W. S. Harrison

District Engineer

W. S. Harrison
jh

P. O. Box 219, 1370 Hamilton Street, Somerset, New Jersey 08873

August 28, 1972

Mr. W. S. Harrison
District Engineer
Armco Steel Corporation
Metal Products Division
P. O. Box 6793
Baltimore, Md. 21204

Dear Mr. Harrison:

I have included a copy of the water analysis which you requested in your letter of August 2, 1972.

The specifications for this job called for the pipe to be "bituminous coated and asbestos bonded".

We have removed one of the stubs which was corroded and have taken it to this office. I talked to Dale Smith today, and he intends to be here on Friday, September 1st. At that time I believe we can determine exactly what was provided on the job.

I have also included a swatch of the coating and some additional photographs. As I mentioned to you last week on the phone, the coating can easily be peeled off in the area where the corrosion has taken place.

Very truly yours,

CARL MONTANA, P.E.
Design Engineer

Enclosures

CM/jb